REMARKS

Claims 1-5 and 7-20 are pending in the application. Claim 6 has been canceled. Claims 10-20 are new. The applicant submits that claims 10-20 do not constitute new matter.

The applicant believes the pending claims are allowable over the art of record for the reasons set out below and therefore respectfully requests reconsideration and allowance of all pending claims.

Rejections Under 35 U.S.C. §103(a)

Claims 1, 2, and 5

The examiner rejected claims 1, 2, and 5 are rejected under 35 U.S.C. §103(a) as being anticipated by Johnson et al. (U.S. Patent No. 4,117,312) in view of Horsma (U.S. Patent No. 4,314,145).

The applicant respectfully submits that claims 1, 2, and 5 are not obvious to one of ordinary skill in the art based on the examiner's proposed combination of *Johnson* and *Horsma*. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.[1] The examiner asserts that it would have been obvious to substitute the PTC layer 36 of *Johnson* with a sheath of PTC material as taught by *Horsma* to provide for "better" electrical characteristics and ease of manufacture. However, in deciding whether the claims are obvious, the prior art references must be considered in their entirety, i.e., as a whole, including portions that lead away from the claimed invention.[2] *Johnson* only teaches the heating material 38 extending between the conductors 10, 12 for a very specific reason, ease of manufacture. It is much easier to manufacture the heating material taught by *Johnson* as a separate unit to be installed between the conductors during assembly than it is to encase the conductors when manufacturing the heating material. With the heating material only being located between the conductors, *Johnson* is only concerned with controlling the amount of heat generating current flowing from the conductors to the heating material. Current flowing through the conductors 10, 12 otherwise would not be a concern because of the insulation material 40 protecting the outer portions. Thus, because the

[1] *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990); *see also In re Fritch*, 972 F.2d 1260, 23 U.S.P.Q.2d 1780 (Fed. Cir. 1992).

[2] *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

heating material is only between the conductors, there would be no need to completely surround either of the conductors 10, 12 with PTC material, which is why *Johnson* teaches a PTC layer 36 only on a portion of the conductor 10 instead of a PTC sheath surrounding the entire conductor. The examiner asserts that electrode conductors for generating heat completely encased in a PTC layer/sheath, as described by *Horsma*, are known in the art and provide "better" electrical characteristics and "ease" of manufacture. However, the applicant respectfully disagrees. The examiner simply makes a conclusory statement that the electrical characteristics would be "better" without listing what those characteristics are and whether those characteristics would be considered "better" in the assembly taught by *Johnson*. Thus, there is no objective evidence of any characteristics that are "better" that would support a *prima facie* case of obviousness. Additionally, the examiner's assertion of "ease" of manufacture is also conclusory and unsupported. The examiner does not explain how or why it would be easier to manufacture a conductor completely encased in a sheath rather than simply placing a strip of material on one side of the sheath. The applicant submits that it could just as easy to provide a simple strip of PTC material on one side of a conductor as enclosing the conductor in an entire sheath. Thus, there is also no objective evidence that it would be "easier" to manufacture the conductor with an entire sheath of material that would support a *prima facie* case of obviousness. In addition to making conclusory and unsupported statements, the examiner completely ignores the important aspect of cost of manufacturing. Heating cables are typically not very expensive and the cost of manufacturing can be extremely important. Thus, *Johnson* actually teaches away from providing a complete sheath of PTC material because doing so would be overkill and lead to unnecessary materials and manufacturing cost. *Johnson* teaches that the complete sheath of PTC material is unnecessary and thus only uses a strip of PTC material so that material costs and assembly costs can be kept to a minimum, thus increasing the commercial viability of the *Johnson* heating cable. Thus, the examiner has not provided any objective evidence of a reason to combine *Johnson* with *Horsma* and, in fact, *Johnson* teaches away from the proposed combination. As such, the examiner has not provided a *prima facie* case of obviousness and the applicant requests that the rejection be withdrawn.

In addition to not providing objective evidence of a reason to combine, *Johnson* was published nearly thirty years ago and yet the applicant is not aware of the existence of any other

electrical heating cable on the market made according to the claimed subject matter of the present application. If the invention were indeed obvious in light of *Johnson* and *Horsma*, a commercial product would have been brought to market by now. Even further, the assignees of the *Johnson* and *Horsma* patents are Thermon Manufacturing Company, and Raychem Corporation respectively. These are both large multinational companies well known by all in the field of electrical heating cables. *Johnson* and *Horsma* were both filed and published in the late 1970s/early 1980s and have thus been published and owned by one of the leading companies in the filed. Therefore, at the time of the priority date of this application, a person of ordinary skill in the art would have had at least twenty years in which to combine the disclosures of *Johnson* and *Horsma* to create a heating cable having all of the features of the claimed invention. If the claimed invention is an obvious modification of *Johnson* and *Horsma*, then why in those 20 years has no one used the teachings of *Johnson* and *Horsma* to create and disclose a heating cable as claimed? The applicant respectfully submits the reason is because the claimed invention is truly not obvious over *Johnson* in view of *Horsma*. The applicant respectfully submits that the examiner is using the disclosure of the current application to piecemeal together the claimed invention through *Johnson* and *Horsma* and that doing so amounts to impermissible hindsight.

The applicant also provides further evidence that the combination of features disclosed in the claimed subject matter is not obvious. With this response, the applicant encloses two data sheets, one by Thermon (the Assignee of *Johnson*) and one by Raychem (the Assignee of *Horsma*). Both of these data sheets illustrate heating cables currently sold by Thermon and Raychem. The examiner will notice that their construction is that disclosed in *Heizer*. That is, neither of the heating cables sold by Raychem or Thermon as detailed in the attached sheet have a sheath of PCT material encasing the conductor. This is clear evidence that the skilled person not only would not combine the features in the document cited by the examiner to realize the claimed subject matter, but that one or ordinary skill has not combined those features. The data sheets enclosed are clear evidence that the heating cable currently sold by Thermon and Raychem is that disclosed in *Heizer*, and not that as claimed in this application. The examiner asserts that a sheath of PTC material would have been obvious as being "better." However, the Assignee of *Horsma*, Raychem, has not included this feature in their heating cable. Raychem is clearly aware of being able to use a sheath of PTC material and its supposed "benefits," given

that they are the Assignee of *Horsma*. However, Raychem has not found it obvious to use a sheath of PTC material in their heating cable. Therefore, the use of a PTC sheath of material encasing a conductor and a heating cable cannot be said to be obvious. Instead, both Raychem and Thermon rely on the PTC effect of a resistive heater wire instead of a sheath.

The applicant also submits evidence of the commercial success of the claimed subject matter as further evidence of non-obviousness. Attached is a letter from the applicant's associates in Asia. It can be seen that an order of 1,000,000 metres of constant wattage self-regulating heating cable has been placed (this is the internal name given to the cable of the claimed subject matter). To give the order some context, the applicant's total sales of all cables last year amounted to around 1,100,000 metres. This is clear evidence of commercial interest in, and demand for the product related to the claimed subject matter.

In view of at least the reasons above, the applicant respectfully traverses and submits that claims 1, 2, and 5 are not obvious when considering *Johnson* and *Horsma* and requests that the rejection of claims 1, 2, and 5 be withdrawn.

Claims 1-5

The examiner rejected claim 1-5 under 35 U.S.C. §103(a) as being unpatentable over *Heizer* (U.S. Patent No. 6,144,018) in view of *Horsma*.

The applicant respectfully submits that claims 1-5 are not obvious to one of ordinary skill in the art based on the examiner's proposed combination of *Heizer* and *Horsma*. Specifically, the scope of the cited references does not teach or suggest all the elements of the claimed subject matter. Claims 1-5 recite that "at least one of the conductors is encased in a sheath of material which has a positive temperature coefficient." The examiner asserts that *Heizer* discloses all of the features of claims 1-5, except a sheath of material encasing at least one of the conductors. The examiner asserts that it would have been obvious to substitute the insulation sheath 2 of *Heizer* with a sheath of PTC material as taught by *Horsma*. However, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.[3] In deciding whether the claims are obvious, the prior art references must also be considered in their entirety, i.e., as a

[3] *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990); *see also In re Fritch*, 972 F.2d 1260, 23 U.S.P.Q.2d 1780 (Fed. Cir. 1992).

whole, including portions that would lead away from the claimed invention.[4] *Heizer* specifically discloses that both conductors 1 are sheathed in insulating material 2 and is not concerned with improving on the heat self-limiting characteristics of prior are heater cables. Instead, *Heizer* focuses on solving problems relating to the flexibility and longevity of the heater wire 5 that is wrapped around the conductors 1 sheathed in insulation 2. In fact, as far as self-limiting the heat output of the heater cable, *Heizer* teaches doing so by making the heater wire 5 a PTC material itself, rather than placing a PTC sheath around either of the conductors 1.[5] Thus, one of ordinary skill in the art would not consider modifying *Heizer*'s insulation sheaths 2 because doing so would be completely unnecessary and would not even be a consideration when focusing on the problems *Heizer* attempts to solve. Thus, there would be no need to completely surround either of the conductors 1 with PTC material to control the heat output of the heating cable of *Heizer* and that is why *Heizer* teaches only using insulation sheaths 2 on the conductors 1 and teaches away from including PTC material on the conductors 1 at all.

Further bolstering the above arguments in support of the nonobvious nature of the present invention is the realization of the age of the references. The inventor for the *Heizer* patent is Glenwood Franklin Heizer, also well known to people and corporations in the field of electrical heating cables. *Heizer* was filed only 5 years before the priority date of this application. *Horsma*, on the other hand, was published in 1982. That means that Heizer, a well known inventor in the field of electrical heating cables, would have had 15 years in which to have become aware of the disclosure of *Horsma*, and to use the sheath disclosed therein in the heating cable for which he was about to file a patent application. Quite simply, he did not. *Heizer* did not disclose the use of a PTC sheath encasing a conductor of a heating cable. If the inclusion of the features of *Horsma* were so obvious, and advantageous, why did *Heizer* not include them in his application? Furthermore, in the few years between the publication of *Heizer* and the priority date of this application, again, no heating cable was disclosed having the combined features of the claimed invention. If the claimed invention is an obvious modification of *Heizer* and *Horsma*, then why has no one used the teachings of *Heizer* and *Horsma* to create and disclose a heating cable as

[4] *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

[5] *Heizer*, column 5, lines 1-2.

claimed? The applicant respectfully submits the reason is because the claimed invention is truly not obvious over *Heizer* in view of *Horsma*. The applicant respectfully submits that the examiner is using the disclosure of the current application to piecemeal together the claimed invention through *Heizer* and *Horsma* and that doing so amounts to impermissible hindsight and not to the claims being obvious to one of ordinary skill in the art.

The applicant also again refers to the two data sheets from Thermon (the Assignee of *Johnson*) and Raychem (the Assignee of *Horsma*) as well as letter from the applicant's associates in Asia as further evidence of non-obviousness.

In view of at least the reasons above, The applicant respectfully traverses and submits that claims 1-5 are not obvious when considering *Heizer* and *Horsma*. Thus, The applicant requests that the rejection of claims 1-5 be withdrawn.

Claims 7-9

The examiner rejected claims 7-9 under 35 U.S.C. §103(a) as being unpatentable over *Johnson* in view of *Horsma* as applied to claim 1, and further in view of Cole (U.S. Patent No. 4,684,785). The examiner also rejected claims 7-9 under 35 U.S.C. §103(a) as being unpatentable over *Heizer* in view of *Horsma* as applied to claim 1, and further in view of *Cole*.

Claims 7-9 depend directly and indirectly from allowable claim 1. The applicant refers the examiner to the remarks above regarding claim 1. As claims 7-9 depend from allowable claim 1, The applicant respectfully submits that dependent claims 7-9 are also allowable. The applicant therefore respectfully requests that The examiner remove the rejection of dependent claims 7-9 as well.

CONCLUSION

The applicant respectfully requests reconsideration the pending claims and that a timely Notice of Allowance be issued in this case. If the examiner feels that a telephone conference would expedite the resolution of this case, the examiner is invited to contact the undersigned.

In the course of the foregoing discussions, The applicant may have at times referred to claim limitations in shorthand fashion, or may have focused on a particular claim element. This discussion should not be interpreted to mean that the other limitations can be ignored or dismissed. The claims must be viewed as a whole, and each limitation of the claims must be considered when determining the patentability of the claims. There may also be other distinctions

between the claims and the prior art that have yet to be raised, but that may be raised in the future.

Unless The applicant has specifically stated that an amendment was made to distinguish the prior art, it was the intent of the amendment to further clarify and better define the claimed invention and the amendment was not for the purpose of patentability. Further, although The applicant may have amended certain claims, The applicant has not abandoned its pursuit of obtaining the allowance of these claims as originally filed and reserves, without prejudice, the right to pursue these claims in a continuing application.

If any fees are inadvertently omitted or if any additional fees are required or have been overpaid, please appropriately charge or credit those fees to Conley Rose, P.C. Deposit Account Number 03-2769 (ref. 2135-00500) of Conley Rose, P.C., Houston, Texas.

Respectfully submitted,
CONLEY ROSE, P.C.

/Collin A. Rose, Reg. No. 47,036/

Collin A. Rose
Reg. No. 47,036
P.O. Box 3267
Houston, Texas 77253-3267
(713) 238-8000 (Phone)
(713) 238-8008 (Fax)

Attachments

Appendix

HPT™
Power-Limiting Heating Cable

Product Specifications

Application . . .

Process Temperature Maintenance or Freeze Protection
High performance HPT power-limiting heating cables are designed specifically for process temperature maintenance or freeze protection where high maintain temperatures or high temperature exposure is required.

A coiled resistor alloy heating element (patent pending) provides the power-limiting feature of HPT. This PTC (Positive Temperature Coefficient) characteristic decreases the cable's power output as the heat-traced product temperature increases and allows the cable to be overlapped during installation. The composite construction of the heating element and fiber substrate, plus an additional fiber cushion layer, provide an exceptionally durable high performance heating cable.

HPT cables are approved for use in ordinary (nonclassified) areas, hazardous (classified) areas, and Zone 1 and 2 classified areas.

Ratings . . .

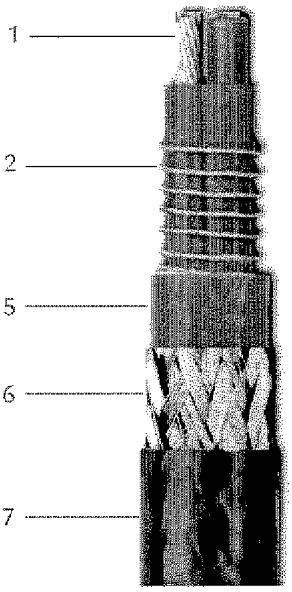
Available watt densities	5, 10, 15, 20 w/ft @ 50°F (16, 33, 49, 66 w/m @ 10°C)
Supply voltages	120/240 Vac nominal [1]
Max. maintenance temperature	300°F (149°C)
Max. continuous exposure temperature	
Power-off	500°F (260°C)
Minimum installation temperature	-60°F (-51°C)
Minimum bend radius	1.25" (32 mm)
T-rating[2]	
Based on stabilized design[3]	T2 to T6

Basic Accessories[4] . . .

Power Connection: All HPT cables require a Terminator, PCA or ECA power connection kit for terminating the circuit before connecting to power.

End-of-Circuit Termination: HPT cables with the metallic ground braid require the use of the ET-7 end cap for terminating at the end of the circuit.

HPT cables with the overjacket wire option require the ET-8 end cap for terminating at the end of the circuit.



Construction . . .

1 Nickel-Plated Copper Bus Wires (12 AWG)
2 Composite Metal Alloy/Fiber
3 Heater Bus Connection (not shown)
4 Fiberglass Braid (not shown)
5 Fluoropolymer Dielectric Insulation
6 Nickel-Plated Copper Braid

Options . . .

7 OJ Fluoropolymer overjacket over nickel-plated copper braid provides additional protection to cable and braid where exposure to chemicals or corrosives is expected.

Notes . . .

1. Higher maintenance temperatures and operating voltages up to 480 Vac may be possible; contact Thermon for design assistance.
2. T-rating per internationally recognized testing agency guidelines.
3. Thermon heating cables are approved for the listed T-ratings using the stabilized design method. This enables the cable to operate in hazardous areas without limiting thermostats. The T-rating may be determined using CompuTrace® Electric Heat Tracing Design Software or contact Thermon for design assistance.
4. Information on additional accessories to complete a heater circuit installation and to comply with approval requirements can be found in the "Power-Limiting Cables Systems Accessories" product specification sheet (Form TEP0018).

THERMON . . . The Heat Tracing Specialists®

ISO 9001 REGISTERED

100 Thermon Dr. PO Box 609 San Marcos, TX 78667-0609
Phone: (512) 396-5801 Facsimile: (512) 396-3627 **1-800-820-HEAT**
www.thermon.com In Canada call **1-800-563-8461**

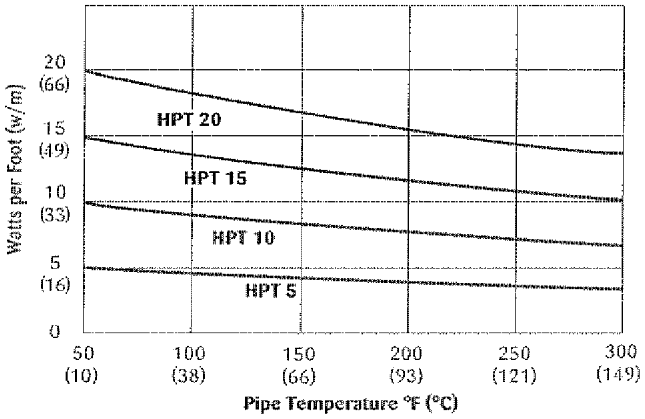
HPT™
Power-Limiting Heating Cable

Product Specifications

Power Output Curves . . .

The power outputs shown apply to cable installed on insulated metallic pipe (using the procedures outlined in IEEE Standard 515-2004) at the service voltages stated below. For use on other service voltages, contact Thermon.

Catalog Number 120 Vac	Zone Length in (cm)	Catalog Number 240 Vac	Zone Length in (cm)	Power Output at 50°F (10°C) w/ft (m)
HPT 5-1	24 (61)	HPT 5-2	30 (76)	5 (16)
HPT 10-1	18 (46)	HPT 10-2	24 (61)	10 (33)
HPT 15-1	18 (46)	HPT 15-2	24 (61)	15 (49)
HPT 20-1	12 (30)	HPT 20-2	24 (61)	20 (66)



Certifications/Approvals . . .

Factory Mutual Research
Ordinary Locations
Hazardous (Classified) Locations
Class I, Division 2, Groups B, C and D
Class II, Division 2, Groups F and G*
Class III, Divisions 1 and 2
Class I, Zones 1 and 2, AEx e II

Underwriters Laboratories Inc.
Ordinary Locations
Hazardous (Classified) Locations
Class I, Division 2, Groups B, C and D
Class II, Division 2, Groups E, F and G*
Class III, Divisions 1 and 2
Class I, Zones 1 and 2, AEx e II

Canadian Standards Association
Ordinary Locations
Hazardous (Classified) Locations
Class I, Division 2, Groups A, B, C and D
Class II, Division 2, Groups E, F and G (requires BNOJ option)
Class I, Division 1, Groups A, B, C and D
Class II, Division 1, Groups E, F and G

*CL. II, Div. 2 requires Thermon design review.

Circuit Breaker Sizing and Type . . .

Maximum circuit lengths for various circuit breaker amperages are shown below. Breaker sizing should be based on the National Electrical Code, Canadian Electrical Code or any other applicable code. For information on design and performance on other voltages, contact Thermon.

The National Electrical Code and Canadian Electrical Code require ground-fault protection of equipment for each branch circuit supplying electric heating equipment. Check local codes for ground-fault protection requirements.

120 Vac Service Voltage		Max. Circuit Length vs. Breaker Size ft (m)			
Catalog Number	Start-Up Temperature °F (°C)	20A	30A	40A	50A
HPT 5-1	50 (10)	325 (99)	445 (136)	[illegible]	[illegible]
	0 (-18)	325 (99)	445 (136)	[illegible]	[illegible]
	-20 (-29)	325 (99)	445 (136)	[illegible]	[illegible]
	-40 (-40)	325 (99)	445 (136)	[illegible]	[illegible]
HPT 10-1	50 (10)	165 (50)	260 (79)	315 (96)	[illegible]
	0 (-18)	165 (50)	260 (79)	315 (96)	[illegible]
	-20 (-29)	165 (50)	260 (79)	315 (96)	[illegible]
	-40 (-40)	160 (49)	250 (76)	310 (95)	[illegible]
HPT 15-1	50 (10)	115 (35)	175 (53)	245 (75)	250 (76)
	0 (-18)	105 (32)	160 (49)	220 (67)	250 (76)
	-20 (-29)	100 (30)	150 (46)	210 (64)	235 (72)
	-40 (-40)	95 (29)	145 (44)	205 (63)	230 (70)
HPT 20-1	50 (10)	75 (23)	115 (35)	160 (49)	205 (62)
	0 (-18)	70 (21)	105 (32)	145 (44)	185 (56)
	-20 (-29)	65 (20)	100 (30)	140 (43)	175 (53)
	-40 (-40)	65 (20)	100 (30)	135 (41)	170 (52)

240 Vac Service Voltage		Max. Circuit Length vs. Breaker Size ft (m)			
Catalog Number	Start-Up Temperature °F (°C)	20A	30A	40A	50A
HPT 5-2	50 (10)	655 (200)	885 (270)	[illegible]	[illegible]
	0 (-18)	655 (200)	885 (270)	[illegible]	[illegible]
	-20 (-29)	655 (200)	885 (270)	[illegible]	[illegible]
	-40 (-40)	645 (197)	815 (248)	885 (270)	[illegible]
HPT 10-2	50 (10)	335 (102)	525 (160)	620 (189)	[illegible]
	0 (-18)	335 (102)	525 (160)	620 (189)	[illegible]
	-20 (-29)	335 (102)	525 (160)	620 (189)	[illegible]
	-40 (-40)	325 (99)	500 (152)	620 (189)	[illegible]
HPT 15-2	50 (10)	230 (70)	355 (108)	495 (151)	500 (152)
	0 (-18)	210 (64)	320 (98)	440 (134)	500 (152)
	-20 (-29)	200 (61)	310 (94)	425 (130)	480 (146)
	-40 (-40)	190 (58)	295 (90)	405 (123)	455 (139)
HPT 20-2	50 (10)	155 (47)	235 (72)	325 (99)	415 (127)
	0 (-18)	140 (43)	215 (66)	295 (90)	370 (113)
	-20 (-29)	135 (41)	205 (63)	280 (85)	355 (108)
	-40 (-40)	130 (40)	200 (61)	270 (82)	340 (104)

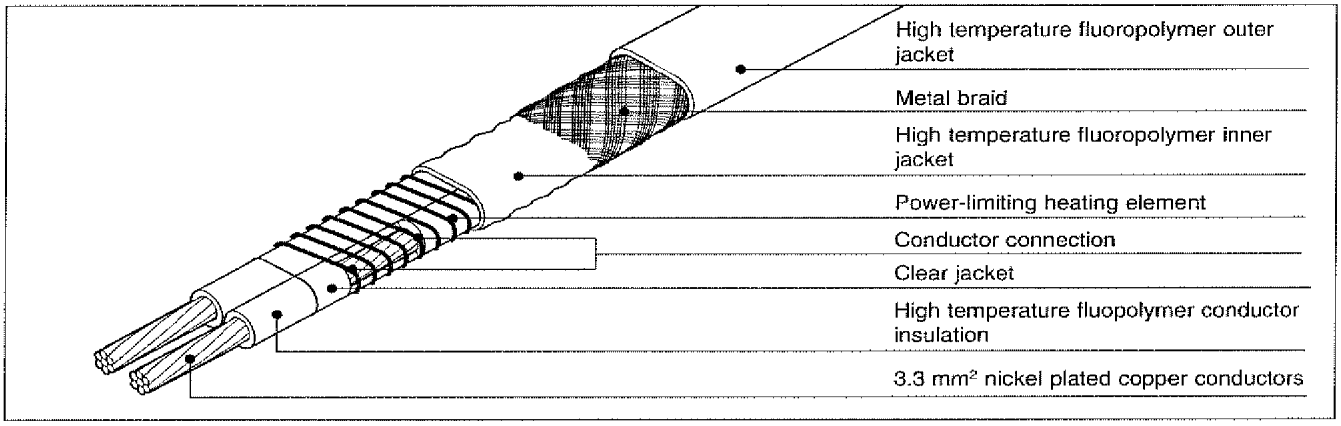
Form TEP0011-0105

Printed in U.S.A.

⟨Ex⟩ High-temperature power-limiting heating cable

VPL is a family of power limiting heating cables designed for pipe and equipment heat-tracing in industrial applications. VPL can be used for frost protection and process temperature maintenance requiring high power output and/or high temperature exposure. VPL can provide process temperature maintenance up to 230°C and can withstand routine steam purges and temperature exposure to 250°C with power off.
Power-limiting cables are parallel heaters formed by a coiled resistor alloy heating element wrapped around two parallel conductors. The distance between conductor contact points forms the heating zone length. This parallel construction allows it to be cut to length and terminated on site. The power output of VPL heating cables decreases with increasing temperature. VPL heating cables can be overlapped. The relatively flat power temperature curve of VPL ensures a low start-up current and high output at elevated temperatures. VPL cables are approved for use in hazardous areas. Approvals are listed below.

Heating cable construction



Application	
Area classification	Hazardous, Zone 1, Zone 2 (Gas), Zone 21, Zone 22 (Dust) Ordinary
Traced surface type	Carbon steel Stainless steel Painted or unpainted metal
Chemical resistance	Organics and corrosives For aggressive organics and corrosives consult your local Tyco Thermal Controls representative
Supply voltage	230 or 254 Vac (Contact your local Tyco Thermal Controls representative for data on other voltages)
Approvals	The VPL heating cable is approved for use in hazardous areas by Baseefa 2001 Ltd. BAS00ATEX2163X ⟨Ex⟩ II 2 GD Ex es II T* * By design

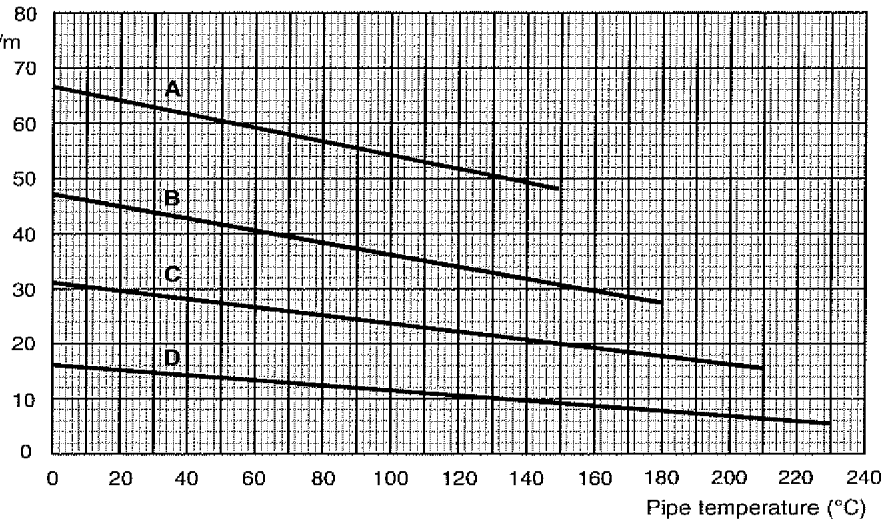
Specifications

Maximum maintain temperature (continuous power on)	**Cable**	**230V**	**254V**
	5VPL2-CT	230°C	225°C
	10VPL2-CT	210°C	200°C
	15VPL2-CT	180°C	145°C
	20VPL2-CT	150°C	Not allowed
Max. exposure temperature (continuous power off)	250°C		
Temperature classification	To be established using the principles of stabilized design. Use TraceCalc design software or contact Tyco Thermal Controls for assistance.		
Minimum installation temperature	–60°C		
Minimum bend radius	at –60°C: 20 mm		

Thermal output rating

Nominal power output rating on metal pipes at 230 V

A 20VPL-CT
B 15VPL-CT
C 10VPL-CT
D 5VPL-CT



To choose the correct heating cable for your application use the TraceCalc design software.

Adjustment Factors for 254V

	Power Output	Circuit Length
5VPL2-CT	1.20	1.05
10VPL2-CT	1.19	1.04
15VPL2-CT	1.19	1.04
20VPL2-CT	Not allowed	

	5VPL2-CT	10VPL2-CT	15VPL2-CT	20VPL2-CT
Nominal power output (W/m at 10°C)	15	30	45	61
Product dimensions (nominal) and weight				
Thickness (mm)	7.9	7.9	7.9	7.9
Width (mm)	11.7	11.7	11.7	11.7
Nominal cold lead/ heating zone length (mm)	1219	914	610	508
Weight (g/m)	200	200	200	200

Maximum circuit length based on type 'C' circuit breakers according to EN 60898

230V		5VPL2-CT	10VPL2-CT	15VPL2-CT	20VPL2-CT
Electrical protection sizing	Start-up temperature	Maximum heating cable length per circuit (m)			
16A	–20°C	195	100	70	50
	+10°C	215	110	75	55
25A	–20°C	220	155	105	80
	+10°C	220	155	115	85
32A	–20°C	220	155	130	100
	+10°C	220	155	130	110
40A	–20°C	220	155	130	110
	+10°C	220	155	130	110

The above numbers are for circuit length estimation only. For more detailed information please use the Tyco Thermal Controls TraceCalc software or contact your local Tyco Thermal Controls representative.
Tyco Thermal Controls requires the use of a 30 mA residual current device to provide maximum safety and protection from fire. Where design results in a higher leakage current, a maximum 300 mA residual current device may be used. All safety aspects need to be proven.

Ordering details

Part description	5VPL2-CT	10VPL2-CT	15VPL2-CT	20VPL2-CT
Part No.	451828-000	892652-000	068380-000	589252-000

Components Tyco Thermal Controls offers a full range of components for power connections, splices and end seals. These components must be used to ensure proper functioning of the product and compliance with electrical requirements.

The
Heat Tracing
Authority™

HEAT TRACE™
SETTING THE STANDARDS LEADING THE WAY

Heat Trace Asia Limited
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April 19, 2007

Constant Wattage Self Regulating (CWSR) Heating Cable

Dear Mr. O'Connor

Thank you for updating us on your development of the constant wattage self-regulating (CWSR) heating cable. We are very excited about this development. The concept you have described will fulfil a major need in the industry. There are many customers in the Asian market who will be very interested in this product.

In fact, we have received our first order. We discussed this with our Korean customer and after some discussion, he placed an order for 1,000,000 metres of CWSR for a domestic application. The commercial terms are as we discussed and are included in the sales contract.

Kind regards

Myung Seo

祝好！

HEAT TRACE ASIA LIMITED 曦缀商务咨询（上海）有限公司

周　晨
中国区经理
Manager of China
曦缀商务咨询（上海）有限公司
HEAT TRACE ASIA LIMITED